

ADOLESCENT ACADEMIC RESILIENCE: TEACHER-CHILD INTERACTIONS AS
A BUFFER FOR NEGATIVE MOTHER-CHILD RELATIONSHIPS
IN EARLY CHILDHOOD

By

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I. INTRODUCTION

A substantial amount of developmental literature indicates that early childhood is a sensitive period for later academic success (Rimm-Kaufman, Pianta, & Cox, 2000). *Academic success* is generally defined as children's demonstration of understanding academic information across various domains (e.g., math, science, history; DeRosier, Kupersmidt, & Patterson, 1994). Adolescent academic success is comprised of such skills as those applied in language, literacy, and mathematics. In addition to these skills, an adolescents' grade point average (GPA) reflects a combination of skills that are not understood or expressed by any individual assessment, including: academic knowledge, test performance, classroom engagement, and assignment performance (Bowers, 2011). In general, research has shown that encountering an adverse experience in early childhood, such as having a negative parent-child relationship, is associated with significantly higher rates of learning difficulties and has been shown to be negatively relate to adolescent academic success (Masten et al., 1999). Resilience research has focused attention on the experiences and characteristics of children who succeed academically even after encountering an adverse experience.

Researchers have demonstrated that positive relationships between adults and children are beneficial for children's development and can be influential on their ability to succeed academically (Cash, Ansari, Pianta, & Grimm, 2018; Landry, Smith, Swank, Assel, & Vellet, 2001). In particular, consistent, high quality, and supportive interactions in early childhood with social partners (e.g., parents, teachers) have been linked to children's cognitive development, the strongest predictor of academic success (Varnhagen, Morrison, & Everall, 1994). Moreover, independent of risk factors

associated with family and child demographic characteristics, the quality of children's home environment (e.g., parent-child relationship) has been shown to be positively related to growth in academic domains for elementary age children (Bradley, 2013). Conversely, negative interactions, particularly with mothers in early childhood, is a risk factor within the child's environment that increases the probability of future problems in development and negative or undesirable outcomes (Buehler & Gerard, 2013). While negative mother-child relationships have been shown to be detrimental to child academic outcomes in late elementary, research has yet to examine if negative mother-child relationships in early childhood have lasting effects for adolescent academic success. Additionally, for children who face relational adversity in early childhood, it is important to identify factors that can serve as a buffer for negative academic outcomes.

Supportive teacher-child interactions have shown to buffer well-documented drops in motivation, engagement, and academic success throughout childhood due to early childhood adversity, such as unequal access to high quality instruction and family conflict (Niehaus, Rudasill, & Rakes, 2012; Roeser, 2005; Way, Reddy, & Rhodes, 2007; Vagi, 2008). Additionally, studies involving 3- to 6-year-old children (Moss et al., 2005; Pianta & Stuhlman, 2004), 7- to 13-year-old children (Murray & Greenberg, 2000, 2006), and 16- to 19-year-old adolescent students (Lerner & Kruger, 1997) have found a positive association between teacher-child relationships and school functioning. Yet, the direct link between positive teacher-child relationships throughout childhood and academic success in any subgroup or population, particularly adolescents facing adversity, has been underrepresented. Despite research findings that positive teacher-child interactions are an influential factor that can promote academic resilience, there is a

lack of integrated research focused on how teacher-child interactions throughout childhood influence adolescents' academic success, specifically for children who have faced relational adversity (i.e., negative mother-child relationship) in early childhood. Teacher-child interactions might serve as a protective resource that help children at-risk for academic failure due to an early negative mother-child relationship.

Thus, to augment our knowledge on adolescent academic resilience there is still a need for longitudinal research examining protective factors throughout childhood for children who experience relational adversity in early childhood. The aims of the current study are threefold: 1) to examine whether children's negative mother-child relationships in early childhood are related to adolescent academic success (i.e., GPA, language, literacy, and mathematics), 2) to examine whether children's positive teacher-child interactions throughout elementary are related to adolescent academic success, and 3) to determine if the relation between negative mother-child relationships in early childhood and adolescent academic success is moderated by the quality of children's interactions with teachers throughout childhood. The findings will further the understanding of whether positive teacher-child interactions play a buffering role against the adverse effects of negative mother-child relationship for adolescents' academic success.

Academic Resilience

A growing body of research indicates that the school environment is an important avenue that can actively buffer against adversity (Glover, Burns, Butler, & Patton, 1998; Patton et al., 2000) and promote resilience among young people (Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003). To study resilience, identification of the threat to development (i.e., adversity), the criteria by which adaptation is judged to be successful,

and the features of the child or the environment that help to explain resilient outcomes must be specified (Masten et al., 1999). Despite the substantial amount of literature describing resilience, there is considerable cross study variation in the definitions of resilience. Consequently, many studies on resilience have been examined across various adversities, with emphasis on different risk and protective factors, and looking at different outcomes (Olsson et al., 2003). *Academic resilience*, one such outcome and the focus of the current study, refers to a student succeeding academically, despite being exposed to an adverse life circumstance such as abuse or neglect (Wang, Haertel, & Walberg, 1998). Example promoting or suppressing factors of academic resilience include relationships/connections, sense of well-being, and stress management.

There has been considerable interest in exploring factors in early childhood that influence academic resilience. Resilience promoting factors and protective processes lie within the individual, within the family network, and within the whole school environment (Olson et al., 2003). For example, a quantitative study conducted by Toldson (2008) examined the social, emotional, and cognitive factors contributing to the academic success of school-age African American males ($N=5,779$). Toldson (2008) identified four empirically linked components to academic success: 1) personal and emotional factors (e.g., such as emotional well-being and self-esteem); 2) family factors (e.g., household composition, parents' education and relationship with their children); 3) social and emotional factors (e.g., economic standing and community involvement); and 4) school factors, relating to their perceptions of school and relationships with teachers. Additionally, Scales et al. (2006) conducted a longitudinal study and found that among middle and high school students, higher levels of resilient traits were strongly correlated

with a higher GPA. These findings support other research suggesting that family factors and school factors impact academic resilience which can significantly affect school outcomes for youth, including academic success (Banerjee, 2016).

When children receive a substantial amount of their care from adults besides their parents (e.g., teachers and child-care providers) then these adults become linked together in fostering a child's resilience. The protective model of resilience demonstrates that a resource (e.g., positive teacher interactions, emotional support) can moderate the effects of a risk (e.g., negative parent-child relationship) on an outcome (e.g., academic success; Fergus & Zimmerman, 2005). The term resource emphasizes the social environmental influences on development in an ecological context resulting in a shift away from conceptualizations of resilience as a fixed, individual trait (Sandler, Wolchik, Davis, Haine, & Ayers, 2003). Additionally, it stresses that an external resource can be a focus of change and help children face risk and moderate a negative outcome. The protective model of resilience supports research suggesting that the quality of children's classroom experiences can have lasting effects for children (Hamre & Pianta, 2005). Supportive school environments can ameliorate a potential risk at home (DuBois, Holloway, Valentine, & Coper, 2002). To better understand factors that contribute to adolescent academic resilience, it is important to examine the potential risk factors or adverse experiences encountered in early childhood (i.e., negative mother-child relationships) and the potential protective factors (i.e., positive teacher interactions) and how they interact with one another (Rutter, 1987).

Negative Mother-Child Relationship and Children's Development

Children can face a variety of adverse experiences including lack of parental support and the absence of one parent (Luthar, 1991). Adverse experiences in early childhood are associated with significantly higher rates of learning difficulties and adjustment problems for children (Anda et al., 2006). Buehler and Gerard (2013) suggest that a negative parent-child relationship in early childhood is a risk factor within the child's environment that increases the probability of future problems in development and for a negative or undesirable outcome. In particular, Caputi, Lecce and Pagnin (2017) suggest negative mother-child relationships (i.e., high degree of conflict and a low degree of closeness) might be one of the main factors that carries risk for children's development. Additionally, Caputi and colleagues mention that the relation between mother-child conflict and developmental outcomes (i.e., academic success) has been shown to remain significant when individual differences in mother's socioeconomic status (SES) and children's early verbal abilities were considered. Research also has been conducted on various types of mothers (e.g., depressed, poor) that tend to experience negative relationships with their child. For example, a cross sectional study was conducted on 816 15-year-old adolescents in Australia to examine the relations between maternal depression, parent-child relationships, and resilient outcomes in the context of risk (Brennan, Brocque, & Hammen, 2003). The study identified that maternal depression negatively impacts the mother-child relationship which negatively impacts youth outcomes (Brennan et al.).

The quality of parent-child relationships has been recognized as a key factor in children's development (Morrison, Rimm-Kaufman, & Pianta, 2003; NICHD Study of

Early Child Care, 2005). For example, Pianta and colleagues (Pianta, Nimetz, & Bennett, 1997) examined 55 high risk-preschoolers relationship quality with their mothers and its effects on school outcomes. The study revealed that the mother-child relationship measures were associated with school outcomes. In particular, mother-child conflict and control problems were negatively related to peer social skills, work habits, frustration tolerance, and overall competency. Indeed, numerous studies demonstrate how academic success during the early school years can be impacted by the parent-child relationship (e.g., De Ruiter & Van IJzendoorn, 1993; Pianta, 1999). In particular, the quality of the mother-child relationship has shown to affect children's school engagement (Perdue, Manzeske, & Estell, 2009) and social competence (Zhange, 2011), which in turn, are both related to academic success (Ladd, Herald, & Kochel, 2006; Lecce, Caputi, & Hughes, 2011). In a study of Canadian children, Moss and St-Laurent (2001) found that maternal attachment at age six predicted cognitive engagement, motivation and academic performance at age eight. Research also has found that relational adversity in early childhood is associated with significantly higher rates of learning difficulties in children (Anda et al., 2006), resulting in children being withdrawn from the classroom environment, which in turn can lead to poor academic success (Birch & Ladd, 1997).

Mother-child conflict is particularly detrimental for children's academic outcomes (e.g., Capitu et al., 2017). According to Vygotsky (1978), children develop skills during interactions with adults (e.g., teachers), resulting in them acquiring the ability to improve their cognitive functions (Lecce et al., 2011). Due to the social context of learning, a negative mother-child relationship can be a disadvantage that can hinder children's academic development. In a longitudinal study examining 45 Italian children's

relationship with their mothers, results indicated that mother-child conflict during preschool is significantly associated with children's academic achievement four years later (i.e., 9 years old, 3rd grade; Caputi et al., 2017). The results from this study are consistent with previous longitudinal studies which identified significant relations between mother-child interaction and children's later school readiness and success in language and mathematics skills (Hess, Holloway, Dickson, & Price, 1984; Pianta, Smith, & Reeve, 1991). Given that academic difficulties experienced by children with negative mother-child relationships can be seen in later childhood, it is surprising that the effects of negative mother-child relationships in early childhood on adolescent academic resilient outcomes have yet to be examined. Thus, the first aim of the current study was to identify if negative mother-child relationships in early childhood have lasting consequences for adolescent academic success.

Teacher-Child Interactions and Children's Development

In considering resilience, the school environment presents an important avenue among young people (Olsson et al., 2003). Researchers have suggested that the social interactions and bonds a child develops at school can act as a buffer against adverse life events and help to promote healthy development (Hawkins & Catalano, 1992; Werner & Smith, 1989). Children's interactions with significant others external to the family (e.g., teachers or caregivers) can be understood from a variety of theoretical viewpoints. Drawing on both Attachment theory and Vygotsky's theory, an adverse challenge is more likely to be faced successfully, and without an impact on children's future academic achievements, if they have positive and warm interactions with caring adults. From the attachment perspective, positive or secure teacher-child relationships are defined by high

levels of closeness and support and low levels of conflict (Davis, 2006). Moreover, theories of motivation suggest that children who experience sensitive, responsive, and positive interactions with teachers are more motivated within academic contexts of schooling (Eccles et al., 1998).

Caring and supportive relationships in schools promote higher academic achievement and higher academic motivation (Blum, McNeely, & Rinehart, 2002). Supportive teacher-child interactions can be characterized by behaviors that reflect a warm and positive emotional climate and show sensitivity to children's needs (Pianta, La Paro, & Hamre, 2008). Children's academic outcomes have been investigated in association with teacher-child relationships. For example, Birch and Ladd (1997) found positive correlations between academic performance, assessed by the Metropolitan Readiness Test (MRT-1; Nurss, McGauvran, Holle, Neely, & Heimberg, 1997) and the quality of teacher-child relationships. In other words, children in classrooms with more positive teacher-child interactions (i.e., high closeness/warmth, low conflict/anger, and open communication) also tend to perform better on the MRT (Hamre & Pianta, 2006). Furthermore, when children establish caring and supportive relationships through quality interactions with their teachers, they also report more positive academic attitudes (Wentzel, Battle, Russell, & Looney, 2010), higher motivation and engagement in academic work (Ryan & Patrick, 2001; Solomon et al., 2000) and higher academic success (Blum et al., 2002). In addition, current research indicates that children's close relationships with teachers, characterized by frequent and positive verbal interactions, can stimulate language development and emergent literacy skills (Chapman, 2000; Split, Koomen, & Harrison, 2015; Wasik & Hindman, 2014).

Observations of supportive teacher-child interactions have been related to children's academic resilience (Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008). In particular, Rudasill, Gallagher and White (2010) research have shown supportive teacher-child interactions to be beneficial for children at risk for poor school performance due to their status on functional (i.e., children's attention, externalizing behavior, social skills, and academic competence) and demographic indicators of risk. For example, researchers have examined the associations between observed supportive teacher-child interactions and children's academic achievement with first grade (Hamre & Pianta, 2005) and third grade (Rudasill et al., 2010) children in the NICHD SECCYD. Notably, in both studies, for children with risk characteristics (e.g., behavior problems or low attention), more positive teacher-child interactions predicted better academic outcomes. Given that children's positive teacher-child interactions serve as a buffer for children at-risk due to family discord and parental maladaptation (i.e., substance abuse or psychiatric disorder), positive teacher-child interactions may also ameliorate the negative effects of not having a positive relationship with their mother for academic success (Mortimer & Call, 2001).

Children's positive interactions with teachers can be a protective factor against their poor performance in school that is associated with an unsupportive home environment (Hamre & Pianta, 2001). For example, Rutter and colleagues (1979) conducted an epidemiological study over a 10-year period in 12 inner London comprehensive schools that established the idea that schools play an important role in youth resilience. Findings indicated that students coming from disadvantaged families were more likely to be resilient if they attended schools that provided an external

protective factor (e.g., attentive and caring teachers, and positive teacher-child relationships; Waxman, Gray, & Padron, 2003). Teacher-child interactions provide opportunities for teachers to promote the reorganization of relational schemata and buffer children from negative developmental outcomes that are associated with problematic early caregiving experiences (e.g., Zajac & Kobak, 2006). Further, Crosnoe, Johnson, and Elder (2004) studied close relationships between friends, siblings, and teachers for youth in problematic family environments. The researchers found that emotional support provided by teachers through a close relationship served as an arena for comfort and promoted academic resilience (Crosnoe et al., 2004). These findings indicate that teachers can facilitate academic resilience for children with conflict in their family environment (Muller, 2001; Nettles, Mucherah, & Jones, 2000).

Despite research suggesting that positive teacher-child interactions promote academic resilience, there is a lack of integrated research connecting teacher-child interactions throughout childhood and their influence on adolescents' academic success specifically for children who faced relational adversity (i.e., negative mother-child relationship) in early childhood. Additionally, much of the research on teacher-child interactions has relied on informant report, either by the teacher or the student (Davis, 2003). This method has been useful in advancing research, however the use of observational measures of teacher-child interactions has emerged as a valid and reliable approach to assess unique aspects of classroom processes that contribute to adolescent development (Pianta & Allen, 2008). Specifically, observational assessments can capture specific instances within teacher-student interactions that is not provided in reports of relational quality and can also aid in clarifying the nature of such supports (Pianta et al.,

2008). Therefore, the current study used observed teacher-child interactions to longitudinally examine whether teacher-child interactions serve as a protective resource that help children at-risk for academic failure due to a negative early mother-child relationship.

II. THE PRESENT STUDY

The current study examines the degree to which positive teacher-child interactions throughout elementary (i.e., first grade, third grade, and fifth grade) moderate the relation between negative mother-child relationships in early childhood (i.e., 54-months) and children's academic success in adolescence (i.e., GPA, language, literacy, and mathematics). Specifically, to examine the moderating effect of positive teacher-child interactions on the relation between relational adversity faced in early childhood and future academic success, the following research questions were explored: (1) Are negative mother-child relationships in early childhood related to adolescent academic success? (2) Are positive teacher-child interactions throughout childhood related to adolescent academic success? And, (3) is the relation between negative mother-child relationships and adolescent academic success moderated by the quality of teacher-child interactions throughout childhood? Based on previous research examining negative-mother child relationships, it was hypothesized that a negative mother-child relationship in early childhood would be negatively associated with adolescent academic outcomes. In turn, it was also hypothesized that positive teacher-child interactions would be positively associated with academic outcomes and mitigate the negative relation between a negative mother-child relationship and academic outcomes.

The strength of the hypothesized associations might depend in part on the children's characteristics. In particular, children's gender is consistently related to mother-child relationships, teacher-child relationships, academic success, and the association between these constructs. Illustratively, studies show that girls tend to have higher academic engagement, GPA, and levels of educational attainment compared to boys (Hao &

Bonstead-Bruns, 1998; Plunkett & Bamaca-Gomez, 2003; Suarez-Orozco & Qin-Hillard, 2004). Relatedly, adolescent research suggests that mothers academic support is more influential for girl's academic motivation than boys (Alfaro, Umaña-Taylor, & Bámaca, 2006; Leaper, Farkas, & Brown, 2012). Moreover, the association between negative parent and negative teacher relationships for school engagement has shown to be stronger for boys than girls (Roorda, Koomen, Spilt, & Oort, 2011). Together these findings suggest that boys are at a greater risk for school failure and the detrimental effects of negative relationships, providing support for the focus on boys in the academic risk perspective (Furrer & Skinner, 2003; Hamre & Pianta, 2001). Accordingly, exploratory analyses were examined to consider gender as a moderator in all analyses. In addition to the child's gender, other child characteristics that have historically been related to academic success were included in analyses as control variables (i.e., child's race, mother's race, mother's education, and income-to-needs ratio).

III. METHODOLOGY

Participants

Participants included children, teachers, and parents from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD SECCYD). Families apart of NICHD SECCYD were recruited in hospitals in or near 10 sites: Little Rock, AK; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA, and Madison, WI. In 1991, research staff visited 8,986 mothers giving birth in these hospitals. Of the initial 5,416 eligible mothers recruited, 1,364 mothers and their families were randomly selected to be in the NICHD study and remained in the sample at the 1-month home visit. Of that original sample, only 1,077 children who had complete mother reports on the Child Parent Relationship Scale (CPRS; see description of measure below) at 54-months were included in the current study. Attrition analyses revealed that the children with complete CPRS data at 54-months ($n=1,077$), compared to those excluded from the analyses due to incomplete CPRS data at 54-months ($n=287$), had mothers with higher levels of education [$t(1361)=4.99, p<.001$], and were more likely to have been white [$t(1362)=2.62, p<.01$]. There was no evidence of differences on socioeconomic status. Additionally, as a whole, the NICHD study had non-random attrition based on income over time, which has been well-documented in previous studies (e.g., Vandell et al., 2010).

Among the 1,077 children included in the current study, 50.5% were male. Children in the sample were majority White (82.7%), followed by African American (11.3%), Other (4.3%), Asian or Pacific Islander (1.4%), and American Indian (.3%).

Mothers of the children in the sample were majority White (84.6%), followed by African American (11.1%), Asian or Pacific Islander (2.2%), Other (1.5%), and American Indian (.6%). The majority of the children (94.4%) were Non-Hispanic and the majority of the children's mothers (96.1%) were Non-Hispanic. Maternal education ranged from 7 to 21 years, with an average of 14.4 years. Socioeconomic status was measured using income-to-needs ratio at 54-months. The ratio was computed from dividing family income by poverty threshold for each household (U.S. Department of Labor, 1994). Income-to-needs ratio ranged from .10 to 56.96 with an average of 3.59. At 54-months, 11.6% of the children in this study lived in a family below the poverty level (income-to-needs < 1).

Procedures

As previously noted, the current study analyzed and focused on the period of 54-months through age 15 (i.e., 54-months, first grade, third grade, fifth grade and age 15/ninth grade.) Data in the current study were obtained from data collection tools that were pre-developed and validated that targeted the children's relationships (i.e., mother-child), interactions (i.e., teacher-child) and academic success (i.e., overall GPA at ninth grade; language, literacy, and mathematics skills at age 15). The data were obtained through parent questionnaires, school observations, and direct assessments by trained data collectors at 54-months, first grade, fifth grade, ninth grade, and age 15. Schools also provided information about the children. Additional information and documentation regarding the data collection procedures and protocols are included in the Manuals of Operation of the NICHD SECCYD (NICHD Early Child Care Research Network, 1993).

Measures

Relational adversity. Adversity faced in early childhood was measured using data obtained from the original 30-item Child-Parent Relationship Scale (CPRS) developed by Pianta (1992) for understanding parent-child relationships. The CPRS, which was adapted from the Student-Teacher Relationship Scale (STRS; Pianta & Steinberg, 1992), assesses how warmly parents view their relationship with their child. The CPRS questionnaire was completed by mothers and asked them to rate how applicable the statements were to their relationship with their child at 54-months of age on a 5-point Likert scale that ranged from “1 (definitely does not apply)” to “5 (definitely applies)”. Two features of the relationship were studied: closeness and conflict. The closeness subscale is an index of the amount of warmth and communication that is present in the relationship (e.g., “I share an affectionate, warm relationship with this child”). The conflict subscale measured the extent to which the relationship is marked by hostile interactions (e.g., “This child and I always seem to be struggling with each other”). The items on the closeness scale were reverse-coded then averaged with the conflict scale to create a negative relationship scale. The alpha level on the CPRS scale was derived from previous use in the Study of Early Child Care Youth Development (SECCYD) and ranged from .81 to .87.

Teacher-Child interactions. To measure teacher-child emotional interaction quality throughout elementary, the current study used observational data obtained from the Classroom Observation System for First Grade (COS-1), Third Grade, (COS-3) and Fifth Grade (COS-5; NICHD Early Child Care Research Network, 2002). The COS-1, COS-3, and COS-5 is successful at obtaining information on the school context at the

level of the individual study child (e.g., teacher-child interactions) and at the level of the classroom (e.g., classroom emotional climate, classroom management), and it also obtains information on child development in the achievement and cognition domain (e.g., engagement in academic tasks). The COS-1 was developed by the SECC Steering Committee for the NICHD Study of Early Child Care and was based on the Kindergarten COS (COS-K) that was developed for the Kindergarten Transition Study and was revised to develop the COS-3 and COS-5, with some constructs changing from grade to grade. Researchers used average global ratings of emotional quality or positive climate from first, third, and fifth grade measured the average positive teacher-child interaction quality children experienced. The mean of COS-1, COS-3, and COS-5 indicated each child's average positive teacher-child interaction quality experienced by the children across elementary (NICHD ECCRN, 2002).

Before rating classrooms, all coders underwent extensive reliability training. Training consisted of attending a workshop at which videos of actual classrooms were observed, discussed, and coded. All trainers read a manual with descriptions and examples of classrooms scored at the various levels. In the reliability test, each coder watched five 20-min segments of classroom interactions. Their scores were compared with master ratings. To be deemed reliable, 80% of a coder's ratings needed to be within 1 scale point of the master ratings. All coders met or exceeded this level of reliability before conducting observations.

Academic success. *Grade nine grade point average (GPA).* Adolescents ninth grade GPA were extracted from official school transcripts and was computed as the average grades they received in math, science, English, and history/social studies. Letter

grades were recoded to numerical equivalents using the following scale: A+ = 4.33, A = 4.0, A- = 3.67, B+ = 3.33, B = 3.0, B- = 2.67, C+ = 2.33, C = 2.0, C- = 1.67, D+ = 1.33, D = 1.0, D- = 0.67, F+ = 0.33, F = 0.0.

Cognitive abilities. To measure the adolescent's verbal abilities, reading achievement, and mathematic achievement, direct assessments were conducted at age 15. Data was obtained from the Woodcock-Johnson Psycho-Educational Battery – Revised (WJ-R; Woodcock & Johnson, 1989). The WJ-R is a wide-range, comprehensive set of tests for measuring cognitive abilities and achievement. At age 15, adolescents completed the Picture Vocabulary (language skills; 58 items, $\alpha = 0.81$), Verbal Analogies (literacy skills; 35 items, $\alpha = 0.86$), and Applied Problems (mathematic skills; 60 items, $\alpha = 0.87$) subscales. In this report, standard scores, which are based on a mean of 100 and a standard deviation of 15 and the equivalent percentile rank, were used.

Data Analysis

Analyses were examined using *Mplus7* (Muthén & Muthén, 1998-2012). At 54-months, 1,077 of the 1,364 children had complete mother-child data on the Child Parent Relationship Scale (CPRS; see description of measure below). To determine whether the children with complete CPRS data were comparable to the children with missing CPRS data, an attrition analysis was conducted by comparing demographic measures. The children with complete CPRS data at 54-Months ($N=1,077$), compared to those with missing CPRS data at 54-months ($n=287$), had mothers with higher levels of education [$t(1361)=4.99, p<.001$], and were more likely to have been white [$t(1362)=2.62, p<.01$]. At age 15 (ninth grade), 608 of those 1,077 children with complete CPRS data had complete data on the outcome measures of interest (i.e., academic success). To determine

whether the children with complete academic success data ($n=608$) were comparable to the children with missing academic success data at age 15 ($n=469$), a second attrition analysis was conducted by comparing demographic measures. The children with complete data at age 15 ($n=608$), compared to those with missing data ($n=469$), were more likely to be male [$\chi^2(1)=3.92, p<.05$], had mothers with higher levels of education [$t(1075)=2.76, p<.01$], were somewhat more likely to have a higher socioeconomic status [$t(1061)=2.24, p<.05$], and were more likely to have been white [$t(1075)=2.85, p<.01$]. To address missing data, all models were estimated using a Full Information Maximum Likelihood (FIML) estimator for the full sample ($N = 933$). The variables that significantly differed (i.e., child's race, mother's race, mother's education, and income-to-needs ratio) were included in the model as covariates to increase the likelihood that the 'missing at random' (MAR) assumption is not violated (Enders, 2010).

To test the study hypotheses using a traditional regression framework, a stepwise approach was utilized. First, a model was estimated including only the covariate variables (i.e., child's race, mother's race, mother's education, and income-to-needs ratio) on each adolescent academic success measure (i.e., GPA, language, literacy, and mathematics). Next, a main effects model in which negative mother-child relationships at 54-months positive teacher-child interactions throughout childhood, and the child's gender were included in addition to the covariate variables. To explore the moderated effect of positive teacher-child interactions on the relation between negative mother-child relationships and adolescent academic success, an interaction effect was added in addition to the covariate variables and main effect variables in a third model. Additionally, all potential interactions between negative mother-child relationships,

teacher-child interactions, and gender, including a three-way model. If moderation was found, follow-up analyses were conducted to examine the simple slopes of the moderated effects. All covariate and independent variables were allowed to correlate in all models. Due to differences in the scales between the predictor variables (i.e., mother child-relationships and teacher child-interactions) these variables were standardized prior to analyses.

IV. RESULTS

Preliminary analyses conducted using SPSS Version 24 examined the descriptive statistics, skewness, and kurtosis of all study variables for the full sample ($N = 1,077$) and separately for female ($n = 533$) and male ($n = 544$) children (see Table 1). Correlations between and among the study predictors (i.e., negative mother-child relationship and positive teacher-child interactions) and outcomes (i.e., overall GPA at ninth grade; language, literacy, and mathematics skills at age 15) revealed significant associations between negative mother-child relationships, positive teacher-child interactions, and adolescent academic success outcomes (see Table 2). Relations between study variables varied slightly by child gender.

In analyses examining the study hypotheses, nearly all of the direct relations between negative mother-child relationships, positive teacher-child interactions, and child's gender on adolescent academic success outcomes were significant (see Table 3). As expected, children whose mothers reported a negative mother-child relationship in early childhood received lower grades in ninth grade (i.e., GPA) and earned lower scores on direct assessments of language and mathematics (WJ-III) at age 15, as compared to peers whose mothers reported more positive mother-child relationships in early childhood. Additionally, girls had a higher GPA compared to boys, yet boys outperformed girls on other academic success measures (i.e., language and mathematics). Furthermore, as hypothesized, having positive teacher-child interactions throughout elementary was positively related to all adolescent academic outcomes (i.e., GPA, language, literacy, and mathematics). The Cohen's effect size for the R -square change was small but significant for GPA ($f^2 = 0.07$), WJ-R literacy scores ($f^2 = 0.01$), and WJ-R

mathematics scores ($f^2 = 0.05$), indicating that the main effects model added predictive validity beyond the covariates.

It was hypothesized that having positive teacher-child interactions would significantly moderate the relation between negative mother-child relationships and adolescent academic outcomes. In support of the hypothesis, there was a significant effect of moderation. Results indicated that positive teacher-child interactions significantly moderated the relation between negative mother-child relationships and adolescent's WJ-R language scores (see Table 3). There were no significant interactions between positive teacher-child interactions and negative mother-child relationships for adolescent's GPA, WJ-R literacy, or WJ-R mathematics scores. The Cohen's effect size for the R-square change was not significant on any outcome when comparing the main effect and interaction models.

Simple slopes were examined to determine the nature of the interaction between mother-child relationships and teacher-child interactions on adolescent's WJ-R language scores (Figure 1). Simple slope analyses revealed that the relation between negative mother-child relationships and WJ-R language scores were significantly negative for children who had low levels of positive teacher-child interactions ($\beta = -3.09, p < .01$) compared to children who had moderate ($\beta = -1.85, p > .05$) to high levels ($\beta = -0.61, p > .05$) of positive teacher-child interactions (Figure 1). Thus, positive teacher-child interactions throughout elementary (i.e., first, third, and fifth grade) play a buffering role against the adverse effects of negative mother-child relationships in early childhood (i.e., 54-months) on adolescent language development.

Gender was considered as a potential moderator of all hypothesized relations (see Table 3). Two effects of gender moderation were found in the relation between negative mother-child relationships and adolescent academic success (i.e., language and mathematics). The simple slopes of gender were examined to determine the nature of the interactions between negative-mother child relationships and gender on adolescent's WJ-R language scores (Figure 2) and WJ-R mathematics scores (Figure 3). Simple slope analyses revealed that the relation between negative-mother child relationships and WJ-R language scores in adolescence was significantly negative for males ($\beta = -0.13, p < .01$) but not females ($\beta = 0.00, p > .05$; Figure 2). Similarly, the relation between negative mother-child relationships in early childhood and WJ-R math scores in adolescence was significantly negative for males ($\beta = -0.13, p < .01$) but not females ($\beta = 0.01, p > .05$; Figure 3). There were no moderation effects for gender in the relations between teacher-child interactions and adolescent's academic success.

V. DISCUSSION

The current study examined the effects of children's negative relationships with their mother in early childhood (i.e., 54-months) and their positive interactions with their teachers throughout elementary (i.e., first grade, third grade, and fifth grade) on adolescent's academic success outcomes (i.e., overall GPA at ninth grade; language, literacy, and mathematics skills at age 15). Specifically, the study examined whether the association between children's negative mother-child relationship and academic success outcomes were moderated by positive teacher-child interactions (i.e., high closeness/warmth, low conflict/anger, and open communication). As hypothesized, negative mother-child relationships adversely affected adolescent's academic success and positive teacher-child interactions supported adolescent's academic success. Furthermore, there was limited support for the hypothesis that positive teacher-child interactions throughout elementary play a buffering role against the adverse effects of negative mother-child relationships in early childhood on an adolescents' academic success (i.e., found only for language skills). Given previous literature linking gender and the study variables, gender was also considered as a moderator in the present study. Gender analyses revealed that the adverse effect of negative mother-child relationships in early childhood for adolescent academic success outcomes (i.e., language and math) was particularly salient for males. The findings from this exploration are discussed in further detail.

In order to understand the current findings, we turn to the cumulative risk perspective. Previous research shows that children have the potential to be academically resilient when exposed to only a single risk factor (Evans, Li, & Whipple, 2013). In this

study, relational adversity in early childhood was considered a risk factor for academic success in adolescence. The emotional context of the relationship with a parent, regardless of the sex of parent, can impact an adolescent's psychological well-being (Reeves & Bamaca, 2012). However, due to the greater amount of time children tend to spend with their mothers than their fathers, a stronger association is often found between mother-child compared to father-child relationships (O'Connor & McCartney, 2007). Research has shown that relational adversity with mothers is related to children's externalizing behaviors (O'Connor, Scott, McCormick, & Weinberg, 2014) and problematic relations with peers (Perdue et al., 2009), which in turn are strong predictors of poor academic achievement (Flook, Repetti, & Ullman, 2005; Masten et al., 2005). The current study's findings are in line with past research, the main effects examining negative mother-child relationships on academic success demonstrated relational adversity in early childhood negatively impacts an adolescents' academic success (i.e., GPA, language, literacy, and mathematics). Despite the negative impact relational adversity can have on adolescent's ability to be successful academically, children can be resilient and overcome exposure to a single risk factor and have the potential to thrive in the face of adversity.

According to Masten (2014), in order to foster resilience, positive factors, influences, and actions must be recognized which can result in a risk factor (i.e., relational adversity) being buffered. The buffering factor considered in the current study was positive teacher-child interactions throughout elementary. The relational nature of the classroom environment is important for children's academic success. Teacher's emotional support characterized by interactions showing mutual respect, positive

communication, opportunities for autonomy, and sensitivity to students' emotions have shown to be particularly important for adolescent academic engagement (Farmer, McAuliffe Lines, Hamm, 2011). For example, Benner, Boyle, and Sadler (2016) conducted a longitudinal study with 15,240 10th grade students that revealed school involvement, including positive interactions with a teacher, was beneficial for at-risk children. Extending the prior literature, the current study revealed significant main effects of having overall positive teacher-child interactions throughout elementary on adolescents' academic success (i.e., GPA, language, literacy, and mathematics).

Many studies on resilience have examined various adversities, with emphasis on different risk and protective factors, and examining different outcomes (Olsson et al., 2003). Research has shown that children's lack of social support can result in maladaptive responses to adversity (Bonanno, 2004; Helgeson and Lopez, 2010). In particular, children's conflictual relationships with their mothers is a risk factor that has been shown to lead to children's academic failure (Flook et al., 2005) and differences among children in language and cognitive abilities (e.g., Fotso et al., 2012; Noble, Houston, Kan, & Sowell, 2012; Phillips & Shonkoff, 2000; Walker et al., 2011). Nevertheless, studies have provided further evidence that a supportive educational environment (e.g., positive teacher-child interactions throughout elementary) can buffer the negative effects of a risk factor (Masten, 2014; Yoshikawa, Wuermli, Raikes, Kim, & Kabay, 2013). The current findings support this previous research and show that positive teacher-child interactions throughout elementary play a buffering role against the adverse effects of negative mother-child relationships in early childhood (i.e., 54-months) on adolescent language abilities.

It is not surprising that there was an effect of moderation for adolescent's language abilities. The bioecological theory of language development demonstrates how children's language development is influenced by and develops from interactions between children and responsive adults (Norris, 2014). In particular, affective tone and responsiveness during mother-child interactions are fundamental in children's language development (Schmitt, Simpson, & Friend, 2011). Therefore, negative mother-child relationships in early childhood can result in a child being isolated from linguistic experiences that are critical for successful language development (Siegler, Saffran, Eisenberg, DeLoache, & Leaper, 2017). However, we know from research in education settings that children experience gains in language skills when positive teacher-child interaction quality is in the moderate to high range (Burchinal, Kainz, & Cai, 2011; Burchinal, Zaslow, & Tarullo, 2016; Hatfield et al., 2016; Weiland et al., 2013). Thus, supporting the notion that adolescents can embody resiliency in language abilities when equipped with positive protective resources throughout childhood.

Interestingly, in the current study, positive high-quality teacher-child interactions did not buffer the effects of a negative mother-child relationship in early childhood on adolescent's GPA, literacy, or mathematics skills. These findings were surprising given that previous research has shown that children in emotionally supportive classroom environments tend to choose more complex cognitive activities (Howes & Smith, 1995) and are more academically successful, which has been shown through both children's grades (e.g., GPA; Rimm-Kaufman & Chiu, 2007; Wentzel, 1998) and their standardized test scores (LaRocque & Mvududu, 2008). Perhaps the differences observed between language skill development and the other academic success outcomes is due the maternal

education of the child. Meta-analytic findings have shown strong associations between maternal education and children's academic success, including adolescents' GPA and Scholastic Aptitude Test (SAT) scores throughout elementary, middle, and high school (Sirin, 2005). Children of mothers with higher levels of education are exposed to higher levels of language through both direct and indirect interactions (Harding, Morris, & Hughes, 2015). Thus, despite having a negative mother-child relationship, high maternal education can positively influence children's language development in indirect ways. Additional research is needed to confirm and explain this finding.

Drawing from the cumulative risk perspective, boys are particularly susceptible and more vulnerable to early caregiving risks and therefore may be less resilient (Beeghly et al., 2017). Exploratory analyses examining gender revealed gender differences in all adolescent academic success outcomes. Consistent with prior research, girls earned a higher GPA compared to boys. Previous research has found that boys are generally less academically engaged than girls (e.g., Bos, Sandfort, De Bruyn, & Hakvoort, 2008; Furrer & Skinner, 2003). Surprisingly, boys outperformed girls on all direct assessments. Additionally, gender significantly moderated the relation between negative mother-child relationships and adolescent academic success outcomes.

Children's perceptions of maternal and paternal rejection contribute to male and female development in different ways. For example, researchers have demonstrated the strong predictive power of parental acceptance among opposite-sex dyads (Li & Meier, 2017). In other words, a lack of maternal acceptance would be more detrimental for boys than girls. Indeed, the adverse effect of negative mother-child relationships in early childhood was particularly salient for adolescent boys' language and math development.

These findings are consistent with previous longitudinal research studies that have documented significant relations between mother–child interactions and children’s later achievement in language and mathematic skills (Hess et al., 1984; Pianta et al., 1991). Maternal rejection resulting in lack of maternal school engagement for males could be a potential casual mechanism for the gender differences found in the current study. Additionally, different social and cultural groups vary in gender ideology which could potentially influence the different expectations for fathers' and mothers' roles impacting the parent-child relationship (Rohner, 2014). Finally, it should be noted that previous research has shown that girls tend to have more positive relationships with their teachers yet, at-risk children, whether male or female, are both strongly influenced by positive relationships with their teachers (Roorda et al., 2011). Consistent with this research, no gender differences were revealed when examining the relation between teacher-child interactions and adolescent academic success in the current study. Furthermore, despite the gender differences and moderation effects observed, there was no evidence of a three-way interaction between negative mother-child relationships, positive teacher-child interactions, and child gender.

Limitations and Future Directions

The limitations of the current study are worth noting as they provide important directions for future research. First, there are important variables not captured in the current study that may significantly influence the observed relations. For example, the impact of other potential risk factors (e.g., child abuse and neglect, racial/ethnic discrimination) on adolescents’ academic success were not measured. Research has shown that multiple risk factors compared to a single risk factor have worse

developmental consequences for children (Sameroff, 2006; Sameroff, Seifer, & McDonough, 2004). In particular, encountering multiple risk factors can negatively impact an adolescent's developmental outcomes and undermine family functioning (Conger & Conger, 2008). Thus, reflecting on the results of the present study, future research should examine positive teacher-child interactions as a buffer for populations considered more at-risk due to encountering multiple risk factors.

One potential risk factor excluded from the current study was the quality of the father-child relationship. Following prior research on relational adversity, which is guided by an extended attachment perspective, the current study focused on mother-child relationships. However, it would be consistent with attachment theory and the cumulative risk perspective to expect that negative father-child relationships would also be a risk factor for adolescent's academic success (Ainsworth, Blehar, Waters, & Wall, 2015). Therefore, future research should include the Child Parent Relationship Scale (CPRS) data completed by the father to examine how negative father-child relationships impact adolescents' academic success.

In addition to other risk factors, other potential buffers could be considered. For example, academic and social support from significant others, such as a peer, is a protective factor that could buffer the impact of a negative mother-child relationship (Hazel, Oppenheimer, Technow, Young, & Hankin, 2014). Additionally, after-school programs and summer school programs can be a buffer and promote resilience among children facing relational adversity. For example, Lauer et al. (2006) meta-analysis revealed a positive overall effect of after-school programs on at-risk student's academic achievement (i.e., reading and mathematics). Therefore, future studies can build on the

current study's research findings by including other potential buffers and protective factors when examining adolescent's academic resilience.

Overall, the children in the current study may have faced fewer risk factors than the general population, thus reducing the generalizability of the results. Due to recruitment and selection criteria, the sample included in the current study were majority white, English-speaking, middle income children and mothers. These characteristics do not reflect the rapidly growing racial/ethnic minority population in the United States which has been projected to constitute over 50% of all children by 2050 (Federal Interagency Forum on Child and Family Statistics, 2013). Additionally, ethnic minority youth often face additional race-related risk factors such as racial discrimination, which has been shown to be a significant risk factor for academic success (Martinez, DeGarmo, & Eddy, 2004). In addition to facing more risk factors overall, racial, ethnic, and cultural variations have the ability to produce a wide range of relational patterns which contribute to how families respond and adapt to adversity (Patterson, 2002). Research has shown that positive parent-child relationships are shaped by cultural norms which affect the meaning and importance of particular parenting behaviors (Crockett, Brown, Russell, & Shen, 2007). Moreover, various dimensions of a parent-child relationships are more salient in certain cultural groups than others. Therefore, the lack of one particular aspect of parent-child relationships in one culture could be presented as a risk factor, but in another context, it could be seen as a strong form of resilience. Furthermore, there are large gaps in educational outcomes for minority adolescents compared to White Americans (Musu-Gillette et al., 2016). For example, research has shown that high school dropout rates among Latinos remain the highest, followed by African-Americans and

then Whites (Kena et al., 2015). Understanding and considering these differences is critical to fully understand the relations among parent-child relationships and academic resilience as well as in designing effective interventions and treatments for all children.

A final limitation is the compositing of only a couple years (i.e., first, third, and fifth grade) of teacher-child interactions throughout elementary. Children's interactions with their teachers and experiences in classrooms could be vastly different from day-to-day and year-to-year throughout elementary and middle school. Research has shown that when children have variability in the amount and quality of their interactions with their teachers throughout the school day, they experience more conflict, resulting in children being less engaged (Pianta & Allen, 2008; Reyes, Brackett, Rivers, White & Salovey, 2012; Wentzel et al., 2010). Therefore, consistent exposure to positive teacher interactions is an important feature of children's school experiences throughout their childhood. Although the findings of the current research on children's average experience with teachers across elementary, the compositing of several years of teacher-child interaction data may be obscuring important nuances related to variability. Multiyear longitudinal studies that observe teacher-child interactions throughout the school year may be an important starting point to address this issue.

Conclusions and Implications

Given existing literature examining teacher-child interaction quality and children's skill development, the study expected to find that quality interactions with teachers (i.e., positive teacher-child interactions) would benefit children, especially for children who experienced relational adversity in early childhood (i.e., negative mother-child relationship). The present study supported these hypotheses and provided further

evidence that positive teacher-child interactions are important and contribute to an adolescent's ability to be academically resilient. In particular, between early childhood and adolescence, children's experiences in the home and school environment (e.g., emotional quality of home environment, classroom emotional quality) impacted their academic success in adolescence. The findings from the current study aligned with previous research demonstrating that home and school settings play a critical role in fostering children's academic skills in school (Bradley, 2013; Hamre & Pianta, 2005).

Implications of the current study support the need for targeted interventions that either reduce children's exposure to adversity, in particular early relational adversity, or that increase children's exposure to protective factors such as positive teacher-child interactions. Interventions such as those focused on developing Theory of Mind, which has been related to parents' rating of prosocial behavior in early childhood and seeks to promote children's socioemotional development (Weimer, Sallquist, & Bolnick, 2012), and play-based parent-child interventions have shown to foster improvements in the parent-child relationship, in particular for mothers and their sons (Wallace, 2018). Beyond interventions aimed at improving and promoting positive mother-child relationships, there are other implications from the present study. Teacher professional development and interventions that promote emotional support for children are of particular relevance because they can cultivate and facilitate improvement in teacher-child interaction quality. Intervening with teachers and improving relational interactions in school settings could be a more cost-effective approach, with a broader impact, than intervening at home. For example, research has demonstrated the effectiveness of one professional development model, MyTeachingPartner (MTP), in improving teacher-child

interaction quality in elementary and secondary classrooms (Allen, Pianta, Gregory, Mikami, & Lun, 2011; Hamre et al., 2012). Additionally, interventions and programs that support teachers in maintaining positive high-quality teacher-child interactions can be especially useful and provide strategies for teachers working with challenging children who are at risk for lower levels of academic success due to a history of adversity in early childhood. Thus, future academic programs and interventions aimed at fostering adolescent academic resilience need to be carefully targeted to better support families, teachers, and children.

Overall, the core findings from the current study are in line with previous research demonstrating that positive teacher-child interactions in the school environment can actively buffer against adversity (Spilt, Hughes, Wu, & Kwok, 2012) and can generate and promote the capacity for resilience among adolescents (Olsson et al., 2003). The malleability of children's academic trajectories provides support for developmental theories that highlight the importance of contextual supports (e.g., positive high-quality teacher-child interactions) on children's developmental outcomes (Ford & Lerner, 1992).

Table 1
 Descriptive Statistics for Negative Mother-Child Relationships, Positive Teacher-Child Interactions, and Academic Success Outcomes.

| | | Total (N = 1,077) | | | | | | | |
|-------------------------------------|-------------------------|-------------------|--------|--------|-------|-------|--------|-------|----------|
| | | N | % | M | SD | Min | Max | Skew | Kurtosis |
| Covariates | | | | | | | | | |
| | Child Race (White) | 1,077 | 82.70% | | | | | | |
| | Maternal Race (White) | 1,077 | 84.60% | | | | | | |
| | Maternal Education | 1,077 | | 14.41 | 2.48 | 7.00 | 21.00 | 0.11 | -0.05 |
| | Income-to-needs | 1,063 | | 3.59 | 3.17 | 0.10 | 56.96 | 5.73 | 77.75 |
| | Child Gender (Female) | 1,077 | 49.50% | | | | | | |
| Negative Mother-Child Relationship | | | | | | | | | |
| | CPRS | 1,077 | | 42.38 | 10.99 | 18.00 | 85.00 | 0.49 | 0.12 |
| Positive Teacher-Child Interactions | | | | | | | | | |
| | COS-1,COS-3,COS-5 | 1,023 | | 31.00 | 7.49 | 5.11 | 40.50 | -1.32 | 0.84 |
| Outcomes (9th Grade; Age 15) | | | | | | | | | |
| | GPA | 674 | | 3.05 | 0.70 | 1.00 | 4.00 | -0.55 | -0.33 |
| | WJ-R Picture Vocabulary | 839 | | 100.16 | 14.69 | 34.00 | 158.00 | 0.31 | 0.98 |
| | WJ-R Verbal Analogies | 841 | | 113.98 | 16.03 | 68.00 | 167.00 | -0.18 | -0.38 |
| | WJ-R Applied Problems | 838 | | 103.03 | 14.14 | 48.00 | 168.00 | 0.78 | 1.46 |

Note. CPRS = Child Parent Relationship Scale. COS-1 = Classroom Observation System at First Grade. COS-3 = Classroom Observation System at Third Grade. COS-5 = Classroom Observation System at Fifth Grade. GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Valid N (listwise) for Outcomes = 596.

| | | Female (n = 533) | | | | | | | |
|-------------------------------------|-------------------------|------------------|--------|--------|-------|-------|--------|-------|----------|
| | | N | % | M | SD | Min | Max | Skew | Kurtosis |
| Covariates | | | | | | | | | |
| | Child Race (White) | 533 | 81.80% | | | | | | |
| | Maternal Race (White) | 533 | 86.00% | | | | | | |
| | Maternal Education | 533 | | 14.51 | 2.46 | 7.00 | 21.00 | 0.15 | 0.04 |
| | Income-to-needs | 529 | | 3.69 | 3.66 | 0.10 | 56.96 | 6.83 | 87.00 |
| Negative Mother-Child Relationship | | | | | | | | | |
| | CPRS | 533 | | 42.35 | 10.89 | 19.00 | 75.00 | 0.51 | -0.06 |
| Positive Teacher-Child Interactions | | | | | | | | | |
| | COS-1,COS-3,COS-5 | 510 | | 31.51 | 7.21 | 5.56 | 40.50 | -1.45 | 1.37 |
| Outcomes (9th Grade; Age 15) | | | | | | | | | |
| | GPA | 354 | | 3.20 | 0.67 | 1.00 | 4.00 | -0.70 | -0.36 |
| | WJ-R Picture Vocabulary | 432 | | 98.59 | 14.81 | 51.00 | 158.00 | 0.42 | 0.66 |
| | WJ-R Verbal Analogies | 434 | | 114.12 | 16.44 | 68.00 | 167.00 | -0.22 | -0.22 |
| | WJ-R Applied Problems | 431 | | 101.65 | 13.81 | 51.00 | 167.00 | 0.81 | 1.43 |

Note. CPRS = Child Parent Relationship Scale. COS-1 = Classroom Observation System at First Grade. COS-3 = Classroom Observation System at Third Grade. COS-5 = Classroom Observation System at Fifth Grade. GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Valid N (listwise) for Outcomes = 310.

| | | Male (n = 544) | | | | | | | |
|-------------------------------------|-------------------------|----------------|--------|--------|-------|-------|--------|-------|----------|
| | | N | % | M | SD | Min | Max | Skew | Kurtosis |
| Covariates | | | | | | | | | |
| | Child Race (White) | 544 | 83.60% | | | | | | |
| | Maternal Race (White) | 544 | 83.10% | | | | | | |
| | Maternal Education | 544 | | 14.31 | 2.50 | 7.00 | 21.00 | 0.08 | -0.14 |
| | Income-to-needs | 534 | | 3.49 | 2.61 | 0.13 | 18.58 | 1.87 | 5.36 |
| Negative Mother-Child Relationship | | | | | | | | | |
| | CPRS | 544 | | 42.40 | 11.10 | 18.00 | 85.00 | 0.47 | 0.29 |
| Positive Teacher-Child Interactions | | | | | | | | | |
| | COS-1,COS-3,COS-5 | 513 | | 30.50 | 7.73 | 5.11 | 39.94 | -1.21 | 0.43 |
| Outcomes (9th Grade; Age 15) | | | | | | | | | |
| | GPA | 320 | | 2.88 | 0.69 | 1.00 | 4.00 | -0.45 | -0.18 |
| | WJ-R Picture Vocabulary | 407 | | 101.82 | 14.40 | 34.00 | 155.00 | 0.23 | 1.54 |
| | WJ-R Verbal Analogies | 407 | | 113.84 | 15.60 | 75.00 | 156.00 | -0.14 | -0.59 |
| | WJ-R Applied Problems | 407 | | 104.48 | 14.36 | 48.00 | 168.00 | 0.75 | 1.55 |

Note. CPRS = Child Parent Relationship Scale. COS-1 = Classroom Observation System at First Grade. COS-3 = Classroom Observation System at Third Grade. COS-5 = Classroom Observation System at Fifth Grade. GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Valid N (listwise) for Outcomes = 286.

Table 2

Correlations between and among Negative Mother-Child Relationships, Positive Teacher-Child Interactions, and Academic Success Outcomes.

| | | Total (N = 1,077) | | | | | |
|-------------------------------------|-------------------------|-------------------|----------|----------|----------|----------|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Negative Mother-Child Relationship | | | | | | | |
| 1 | CPRS | - | | | | | |
| Positive Teacher-Child Interactions | | | | | | | |
| 2 | COS-1,COS-3,COS-5 | -0.02 | - | | | | |
| Outcomes (9th Grade; Age 15) | | | | | | | |
| 3 | GPA | -0.17 *** | 0.18 *** | - | | | |
| 4 | WJ-R Picture Vocabulary | -0.17 *** | 0.15 *** | 0.40 *** | - | | |
| 5 | WJ-R Verbal Analogies | -0.16 *** | 0.16 *** | 0.50 *** | 0.62 *** | - | |
| 6 | WJ-R Applied Problems | -0.15 *** | 0.18 *** | 0.49 *** | 0.59 *** | 0.67 *** | - |

Note. CPRS = Child Parent Relationship Scale. COS-1 = Classroom Observation System at First Grade. COS-3 = Classroom Observation System at Third Grade. COS-5 = Classroom Observation System at Fifth Grade. GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Standardized beta estimates (standard errors) and p-values are reported. * p < .05 ** p < .01 *** p < .001.

| | | Female (n = 533) / Male (n = 544) | | | | | |
|-------------------------------------|-------------------------|-----------------------------------|----------|----------|-----------|-----------|-----------|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Negative Mother-Child Relationship | | | | | | | |
| 1 | CPRS | - | 0.02 | -0.16 ** | -0.25 *** | -0.19 *** | -0.24 *** |
| Positive Teacher-Child Interactions | | | | | | | |
| 2 | COS-1,COS-3,COS-5 | -0.07 | - | 0.14 ** | 0.11 * | 0.14 ** | 0.17 *** |
| Outcomes (9th Grade; Age 15) | | | | | | | |
| 3 | GPA | -0.18 *** | 0.21 *** | - | 0.35 *** | 0.48 *** | 0.49 *** |
| 4 | WJ-R Picture Vocabulary | -0.10 * | 0.18 *** | 0.48 *** | - | 0.59 *** | 0.56 *** |
| 5 | WJ-R Verbal Analogies | -0.12 ** | 0.17 *** | 0.53 *** | 0.66 *** | - | 0.65 *** |
| 6 | WJ-R Applied Problems | -0.07 | 0.18 *** | 0.53 *** | 0.61 *** | 0.69 *** | - |

Note. CPRS = Child Parent Relationship Scale. COS-1 = Classroom Observation System at First Grade. COS-3 = Classroom Observation System at Third Grade. COS-5 = Classroom Observation System at Fifth Grade. GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Correlations between and among the study variables for children who are female are on the lower half of the diagonal and children who are male on the upper half of the diagonal. Standardized beta estimates (standard errors) and p-values are reported. * p < .05 ** p < .01 *** p < .001.

Table 3
Regression Coefficients for Main Effect and Moderation Models on Adolescents Academic Success.

| | GPA | | WJ-R Picture Vocabulary | | WJ-R Verbal Analogies | | WJ-R Applied Problems | |
|---------------------------|---------|------------|-------------------------|------------|-----------------------|------------|-----------------------|------------|
| | β | SE | β | SE | β | SE | β | SE |
| Covariates | | | | | | | | |
| Child Race (White) | -0.02 | (0.05) | 0.14 | (0.05) ** | 0.09 | (0.04) * | 0.09 | (0.05) |
| Maternal Race (White) | 0.17 | (0.05) *** | 0.13 | (0.05) ** | 0.09 | (0.04) * | 0.03 | (0.05) |
| Maternal Education | 0.38 | (0.04) *** | 0.39 | (0.04) *** | 0.39 | (0.04) *** | 0.37 | (0.03) *** |
| Income-to-needs | 0.08 | (0.03) ** | 0.03 | (0.03) | 0.04 | (0.03) | 0.01 | (0.04) |
| Variance (R^2) | 0.23 | (0.03) *** | 0.26 | (0.03) *** | 0.23 | (0.03) *** | 0.20 | (0.02) *** |
| Main Effects Model | | | | | | | | |
| Child Gender (Female) | 0.18 | (0.03) *** | -0.13 | (0.03) *** | -0.01 | (0.03) | -0.11 | (0.03) *** |
| NMCR | -0.08 | (0.03) ** | -0.06 | (0.03) * | -0.05 | (0.03) | -0.06 | (0.03) * |
| PTCI | 0.11 | (0.04) ** | 0.07 | (0.04) * | 0.10 | (0.04) ** | 0.12 | (0.04) *** |
| Variance ($R^2\Delta$) | 0.05 | | 0.03 | | 0.01 | | 0.04 | |
| Moderation Model | | | | | | | | |
| NMCR X Gen | -0.02 | (0.05) | 0.09 | (0.04) * | 0.02 | (0.04) | 0.10 | (0.04) ** |
| PTCI X Gen | 0.05 | (0.06) | 0.03 | (0.05) | 0.01 | (0.05) | -0.02 | (0.05) |
| NMCR X PTCI | 0.00 | (0.05) | 0.08 | (0.04) * | 0.04 | (0.05) | 0.01 | (0.05) |
| NMCR X PTCI X Gen | -0.02 | (0.05) | -0.05 | (0.04) | -0.01 | (0.04) | -0.02 | (0.04) |
| Variance ($R^2\Delta$) | 0.00 | | 0.01 | | 0.00 | | 0.01 | |

Note. NMCR = Negative Mother-Child Relationship. PTCI = Positive Teacher-Child Interactions. Gen = Child's gender GPA = Grade Point Average. WJ-R = Woodcock-Johnson Psycho-Educational Battery – Revised. Standardized beta estimates (standard errors) and p-values are reported. * $p < .05$ ** $p < .01$ *** $p < .001$.

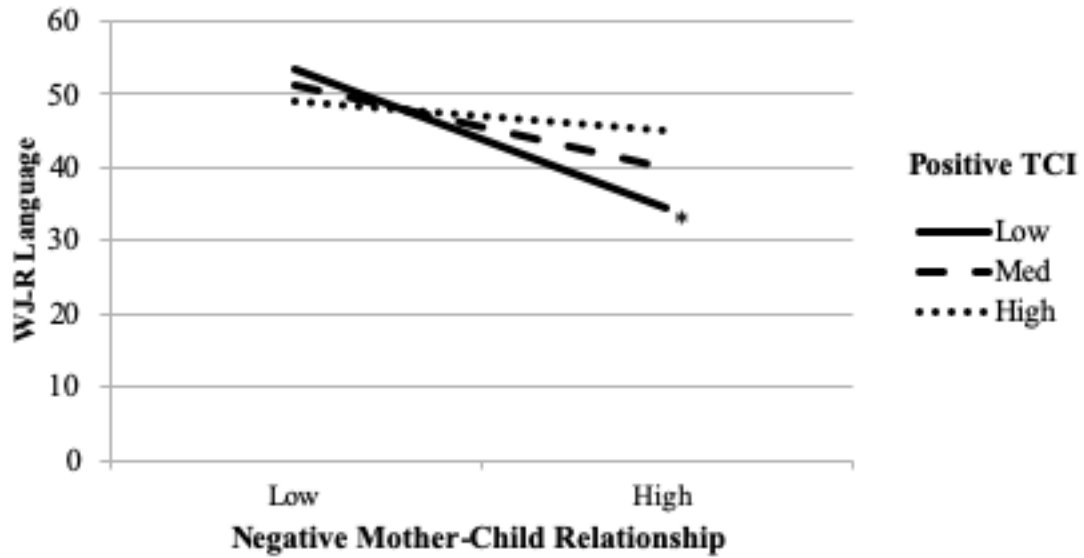


Figure 1. Moderated Effect of Negative Mother-Child Relationships on Adolescents WJ-R Language Scores by Positive Teacher-Child Interactions. *Note.* TCI = Positive Teacher-Child Interactions. Low = Low Positive Teacher-Child Interactions. Med = Medium Positive Teacher-Child Interactions. High = High-Positive Teacher-Child Interactions. * $p < .01$.

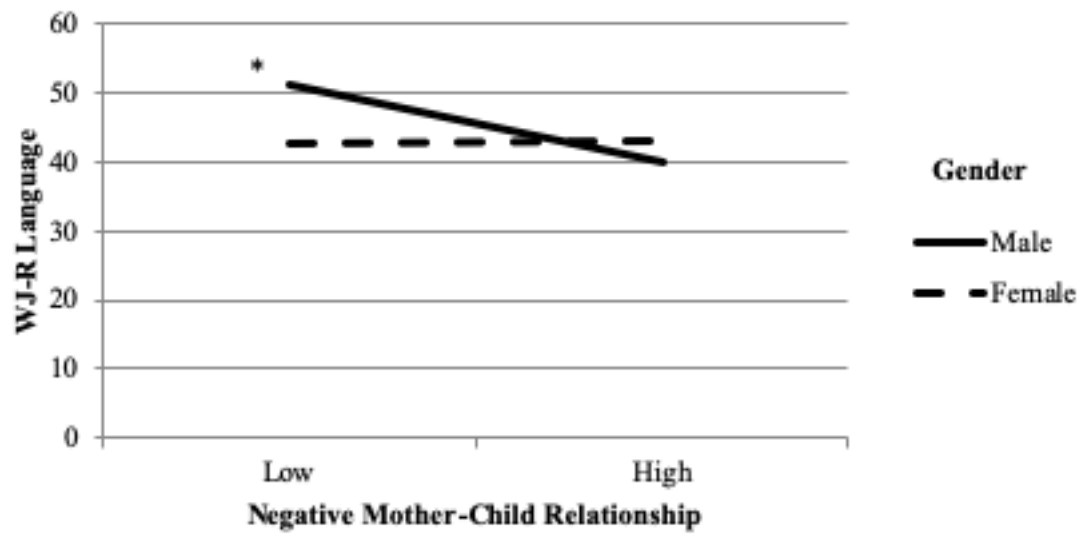


Figure 2. Moderated Effect of Negative Mother-Child Relationships on Adolescents WJ-R Language Scores by Child Gender. Note. * $p < .01$.

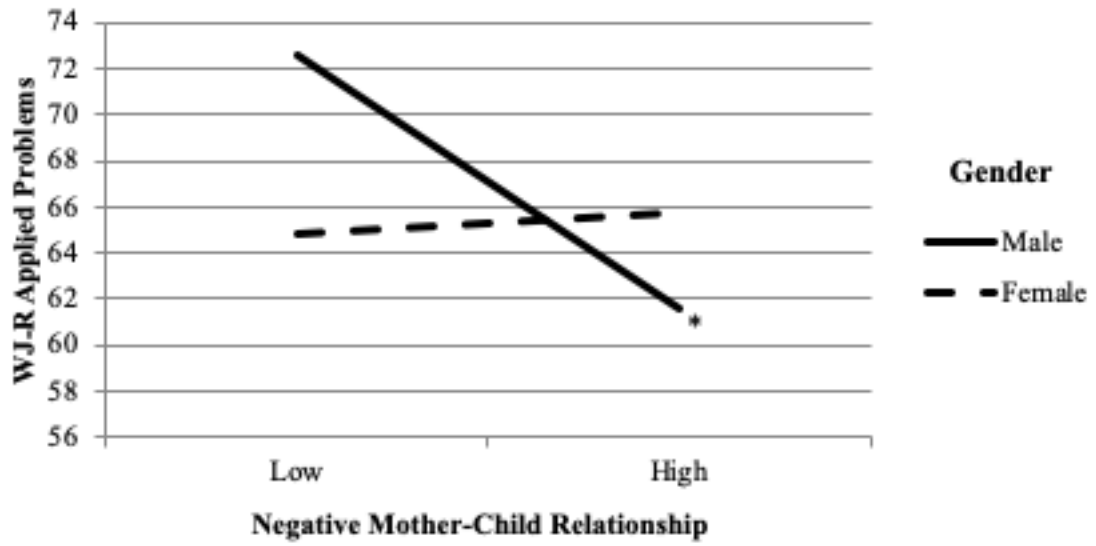


Figure 3. Moderated Effect of Negative Mother-Child Relationships on Adolescents WJ-R Mathematics Scores by Child Gender. *Note.* * $p < .01$.

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